CORRIGE DU SUJET 11

V

$\sum M_{/G} = 0 \Rightarrow 2 - 2V_B + 20 \times 1 = 0$

$\Rightarrow V_B = 11\,kN$

$\sum F_V = 0 \Rightarrow 20 + 5 + 11 - V_D = 0$

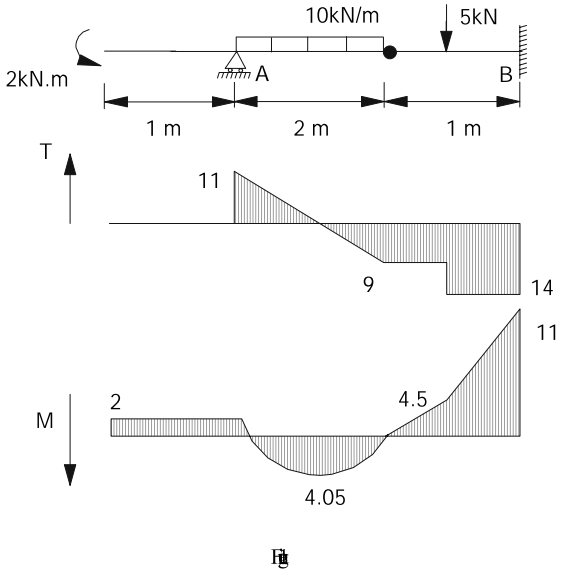
$\Rightarrow V_D = 14\,kN$

$\sum M_{/G} = 0 \Rightarrow M_D + 5 \times 0.5 - 11 = 0$

$\Rightarrow M_D = 11 - 1.5 = 9.5\,kN$

D

T



Fig

T

T = 0

M = - 2 kN. m

T

T = 11 - 10x

T = 0 ⇒ x = 1.1 m

$M = -2 + 11x - 5x^2$

$M_{max} = M(1.1) = 4.05$ kN. m

T

T = - 9 kN

M = - 2 + 11(2) - 20(1) = - 2

T

T = - 9 - 5 = - 14 kN

M = - 11.5 + 14x

Section triangulaire

[illegible]

[illegible]

$I = bh^3/36 = 2.8 \times 10^6\ m^4$

$y_{max} = 2h/3 = 80\ mm$

et $y_{min} = h/3 = 40\ mm$

[illegible]

- [illegible] $M_{max}^{+} = 4.05\ kN\,m$

$$\sigma_{max}^{+} = \frac{M_{max}^{+}\, y_{min}}{I} = \frac{4.05 \times 10^6 \times 40}{2.8 \times 10^6} = [illegible].25\ N/mm^2 \le [\sigma^{+}]$$

$$\sigma_{max}^{-} = \frac{M_{max}^{+}\, y_{max}}{I} = \frac{4.05 \times 10^6 \times 80}{2.8 \times 10^6} = [illegible]\ N/mm^2 \le [\sigma^{-}]$$

- [illegible] $M_{max}^{-} = -11.5\ kN\,m$

$$\sigma_{max}^{+} = \frac{M_{max}^{-}\, y_{max}}{I} = \frac{11.5 \times 10^6 \times 80}{2.8 \times 10^6} = [illegible]\ N/mm^2 \ge [\sigma^{+}]$$ [illegible]

[illegible]

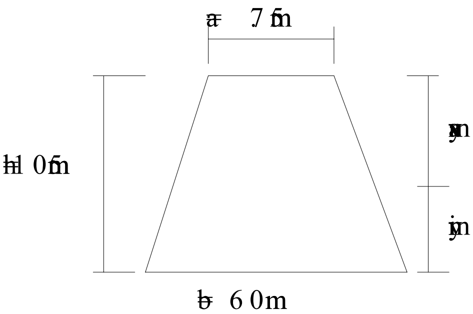
[illegible]

$$\sigma_{max}^{-} = \frac{M_{max}^{-}\, y_{min}}{I} = \frac{11.5 \times 10^6 \times 40}{2.8 \times 10^6} = [illegible]\ N/mm^2 \le [\sigma^{-}]$$

Section trapézoïdale:

[illegible]

[illegible]



[illegible]

$$y_{im} = \frac{h(2a+b)}{3(a+b)} = \frac{105(2x75+60)}{3(75+60)} = 38.9 \text{ mm}$$

$$y_{sm} = 80 - 38.9 = 61.1 \text{ mm}$$

$$I = \frac{h^3(a^2+4ab+b^2)}{36(a+b)} = \frac{105^3(75^2+4x75x60+60^2)}{36(75+60)} = 2.6x10^{6} \text{ mm}^4$$

Flexion

$$\sigma_{sm} = \frac{M_m \cdot y_{sm}}{I} = \frac{11.5x10^{6} x 61.1}{2.6x10^{6}} = 270.4 \text{ N/mm}^2 \quad [\sigma_{tr}]$$

$$\sigma_{im} = \frac{M_m \cdot y_{im}}{I} = \frac{11.5x10^{6} x 38.9}{2.6x10^{6}} = 172.0 \text{ N/mm}^2 \quad [\sigma_{tr}]$$

Diffusion

$$\sigma_{sm} = 60.6 \text{ N/mm}^2 \quad [\sigma_{tr}]$$

$$\sigma_{im} = 10.30 \text{ N/mm}^2 \quad [\sigma_{tr}]$$

On

[illegible] / I [illegible]

[illegible] / I [illegible]

Rapport des flèches maximales:

La [illegible]

$$\frac{f_{sm}}{f_{im}} = \frac{I_{im}}{I_{sg}} = \frac{2.6x10^{6}}{2.8 x10^{6}} = 0.9$$

On [illegible]

En [illegible] / S[illegible]), [illegible]

Poutre continue sur plusieurs appuis:

Pa
is

Ip
fo
g

Pg

$R_2^d = R_2^g = 10\,kN$

$R_3^g = 10\,kN$

$\theta_2^d = \theta_3^g = 10/3\,EI$

p

$R_3^d = 2.\,kN \quad R_3^g = 10 + 2.\,5 = 12.\,kN$

$R_4^g = R_4^d = 2.\,kN$

$\theta_3^d = \theta_4^g = 5\,16\,EI$

O
p2

$M_1 L_1 + 2M_2(L_1 + L_2) + M_3 L_2 = 6EI(\theta_2^g + \theta_2^d)$

$4M_2 + M_3 = 9$

p3

$M_2 L_2 + 2M_3(L_2 + L_3) + M_4 L_3 = 6EI(\theta_3^g + \theta_3^d)$

$2M_2 + 8M_3 + M_4 = 21.\,9$

p4

$M_3 L_3 + 2M_4(L_3 + L_4) = 6EI(\theta_4^g + \theta_4^d)$

$M_3 + 2M_4 = 1.\,8$

O
y

$M_2 = 1.\,kN\,m$

$M_3 = 3.\,0\,kN\,m$

$M_4 = 0.\,6\,kN\,m$

Cette

$$R_i = R_i^0 + \frac{M_{i+1} - M_i}{L_{i+1}} + \frac{M_{i+1} - M_i}{L_i}$$

$$R_1 = \frac{-1.8 - 2}{1} = -0.02\ kN$$

$$R_2 = 10 + \frac{-2 - 1.8}{1} + \frac{-3.07 - 1.8}{2} = 9.435\ kN$$

$$R_3 = 125 + \frac{-1.8 - 3.07}{2} + \frac{-0.6 - 3.07}{1} = 167.5\ kN$$

$$R_4 = 2.5 + \frac{-3.07 - 0.6}{1} = -1.17\ kN$$

Cette

Tron AB :

$$T = -0.02\ kN$$

$$M = -2 + 0.02x$$

Tron BC :

$$T = 9.435 - 10x$$

$$T = 0 \quad \text{pour } x = 0.946\ m$$

$$M = -20 - 0.02(x) + 9.435\left(x - \frac{x^2}{2}\right)$$

$$M_{max} = M(0.946) = 2.48\ kN.m$$

Tron CD :

$$T = 6.15\ kN$$

$$M = -20 - 0.02(x) + 9.435(x) + 6.75(x - 2) = 6.15x - 3.07$$

Tron DE :

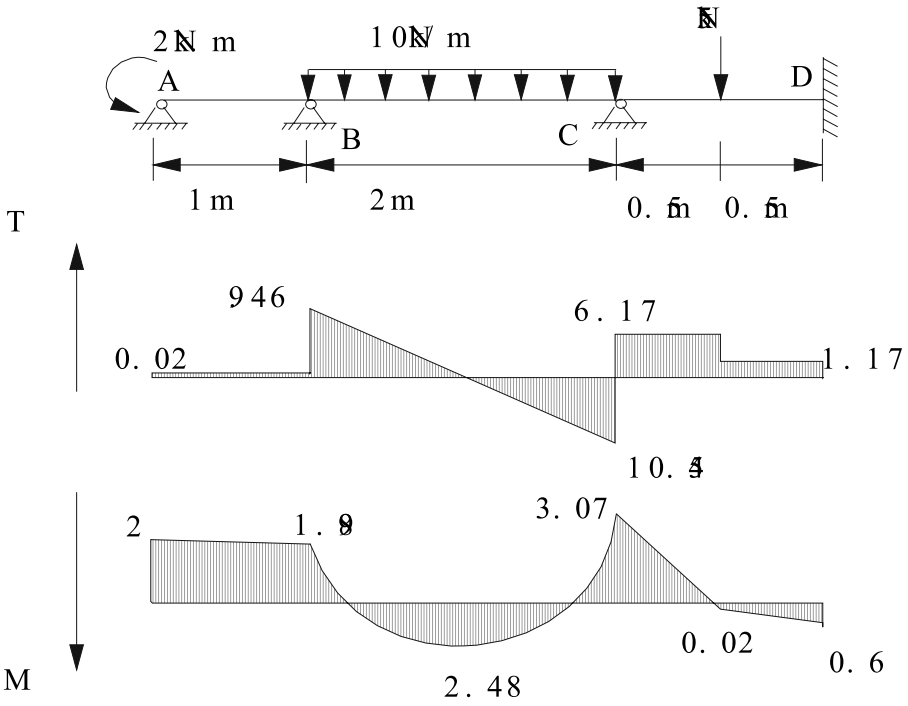
$$T = 6.175 - 1.17$$

$$M = 0.6 - 1.17x$$

L'effort tranchant s'annule pour une valeur de x telle que :

$$6.15 - 10x = 0$$

$$x = 3.07 - 11.5 = 0.26$$


2kN m
10kN/m
5kN
A
B
C
D
1 m
2 m
0.5 m
0.5 m
T
9.46
6.17
0.02
1.17
10.54
M
2
1.98
3.07
0.02
0.6
2.48